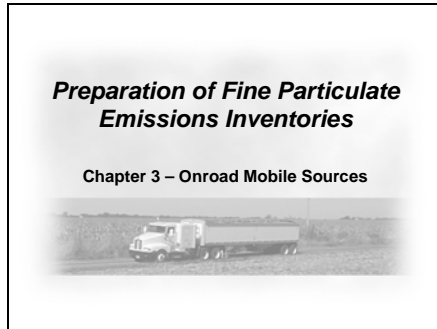


## Chapter 3 – Onroad Mobile Sources

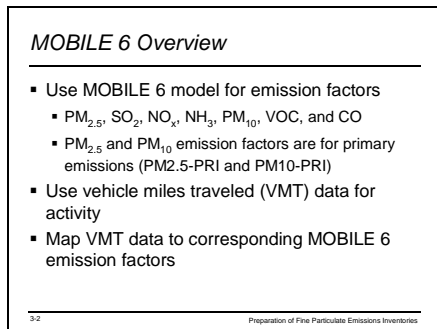
3 - 1



After this lesson participants will be able to:

- describe the EPA's MOBILE 6 model and the National Mobile Inventory Model
- explain how vehicle mileage is used to calculate emissions from onroad vehicles.

3 - 2



EPA's Office of Transportation and Air Quality or OTAQ (pronounced O-TAG) has developed MOBILE 6 to estimate emissions from mobile sources.

The MOBILE 6 model:

- includes emission factors for  $PM_{2.5}$ ,  $SO_2$ ,  $NH_3$ ,  $PM_{10}$ , VOC and CO.
- can be downloaded with its User Guide from [www.epa.gov/otaq/m6.htm](http://www.epa.gov/otaq/m6.htm).
- uses  $PM_{2.5}$  and the  $PM_{10}$  emission factors to represent primary emissions.
- matches data on vehicle miles traveled to the corresponding MOBILE 6 emission factors to form the basis of emission calculations.

3 - 3

*MOBILE 6 Overview (cont.)*

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- Data and algorithms previously in PART5 (with updates where applicable) have been integrated into the MOBILE 6 model
- Fugitive dust emission factors included in PART5 (i.e., re-entrained road dust) removed from MOBILE 6
- MOBILE 6 also includes emission estimates for Gaseous SO<sub>2</sub> and Ammonia (NH<sub>3</sub>)

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3-3 Preparation of Fine Particulate Emissions Inventories

PART 5 was EPA's prior model for modeling PM emissions. Its data and algorithms have been integrated into the MOBILE 6 model, with some updates.

The fugitive dust emission factors included in PART 5 have been excluded from MOBILE 6.

Consequently, the calculation of emissions from re-entrained road dust is done separately outside the model.

Also, MOBILE 6 also includes emission estimates for gaseous SO<sub>2</sub> as well as ammonia.

3 - 4

*MOBILE 6 Modeling Inputs*

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- Use same inputs for MOBILE 6 model as used for previous MOBILE 6 model for same time period
  - Registration distribution
  - Ambient conditions
  - Speeds/speed distribution
  - Fuel parameters
  - Control programs
  - VMT mix

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3-4 Preparation of Fine Particulate Emissions Inventories

In most cases MOBILE 6 uses the same type of inputs that were required for prior versions.

This includes registration, distribution, ambient conditions such as temperature and humidity, speeds and speed distributions, and fuel parameters such as the Reid Vapor Pressure of gasoline and oxygenated fuel.

It also includes control programs such as Stage II or Inspection and Maintenance programs, and data on VMT by vehicle type.

3 - 5

*MOBILE 6 Modeling Inputs (cont.)*

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- Additional data required for MOBILE 6
  - Diesel sulfur content (in parts per million [ppm])
- Additional commands needed for MOBILE 6
  - Described in MOBILE User's Guide
- $PM_{2.5}$  and  $PM_{10}$  emission factors cannot be calculated in same scenario—particle size must be specified in each scenario

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3-5 Preparation of Fine Particulate Emissions Inventories

One additional data input required for MOBILE 6 modeling that was not required in the past is the diesel sulfur content expressed in parts per million.

Also, there are additional commands needed for generating  $PM_{2.5}$  inventories in MOBILE 6.

The commands are described in the MOBILE user's guides developed by OTAQ.

Note that when you develop a PM inventory, you cannot do a  $PM_{2.5}$  and a  $PM_{10}$  inventory simultaneously.

As a result, it is necessary to specify just one particle size per each run.

3 - 6

*National Mobile Inventory Model (NMIM)*

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- Creates national or sub-national emission inventories
- Consolidated emissions modeling system
- Combines a graphical user interface, MOBILE, NONROAD, and a data base
- Data base contains most recent information used in the NEI

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3-6 Preparation of Fine Particulate Emissions Inventories

National Mobile Inventory Model:

- a tool developed by OTAG to create national or sub-national emission inventories for any calendar year
- uses county-specific input parameters
- a consolidated emissions modeling system for EPA's MOBILE and NONROAD models
- combines a graphical user interface, MOBILE, NONROAD, and a database with modeling information for each county in the United States

Currently this database contains the most recent information (e.g., fuel parameters, registration data, temperatures, etc.) used by EPA to generate the default National Emission Inventory estimates for each county.

3 - 7

<p><i>National Mobile Inventory Model (NMIM) (cont.)</i></p> <ul style="list-style-type: none"><li>▪ Calculates criteria pollutants and HAP emissions</li><li>▪ All estimates based on same input parameters</li><li>▪ Used to generate preliminary 2002 NEI for nonroad engines</li><li>▪ Optional for states</li><li>▪ Available for general use in 2004</li><li>▪ Produces same results as MOBILE and NONROAD</li></ul> <p>3-7 <small>Preparation of Fine Particulate Emissions Inventories</small></p>
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**NMIM:**

- can calculate both criteria (including ammonia) and HAPs for the source categories included in the MOBILE6 and NONROAD models.
- consolidates all the model inputs into a single data base such that all the estimates are based on the same input parameters in each county (e.g., fuel programs, inspection/maintenance, humidity, temperatures).
- draft version used to generate the preliminary EPA default 2002 NEI inventories for nonroad engines
- is an optional tool for states to use in estimating mobile source inventories by organizing and automating emission inventory development for highway vehicles and NONROAD categories.
- is not a substantively different approach than directly using MOBILE 6 and NONROAD2002.

The EPA expects to complete NMIM and release it for general use in 2004 but states will not be required to use it to generate inventory estimates.

This tool was developed to make creating inventories easier and does not change the answers that are obtained from running MOBILE or NONROAD individually.

**State use:**

- States may wish to customize all or part of their own inventory generation process to the NMIM model approach.
- This will allow them to take advantage of its efficiency and transparency, and to align the NEI inventory results more closely with their own inventory estimates.
- State and local agencies will be able to use the database to view the county-level default values and to replace them with data that better represents their geographic areas.

3 - 8

<i>Sources of VMT Data</i>	
<ul style="list-style-type: none"><li>▪ State Department of Transportation</li><li>▪ Metropolitan Planning Organization</li><li>▪ 1999 NEI VMT Data based on:<ul style="list-style-type: none"><li>▪ State-provided VMT (8 States)</li><li>▪ FHWA HPMS data summaries<ul style="list-style-type: none"><li>▪ By roadway type and State</li><li>▪ By roadway type and Urban Area</li><li>▪ Nationally by Vehicle Type</li></ul></li></ul></li></ul>	
3-8	Preparation of Fine Particulate Emissions Inventories

State departments of transportation typically provide VMT data.

Metropolitan planning organizations track these data for certain areas. However, VMT data should be used from whatever source it is available.

As a case in point:

- The 1999 NEI included VMT data that was provided by eight states and this data was used in conjunction with MOBILE6 emission factors. VMT data for the remaining states were obtained from the Federal Highway Administration's data summaries.
- The FHWA data contain vehicle miles traveled by roadway type, by state, as well as VMT by roadway type for specific urban areas.
- The 1999 NEI relied upon a national distribution for the VMT mix by vehicle type.
- As a result, the same mix of vehicles was assumed for all areas unless the state provided their own data.

Documentation for the 1999 NEI can be found at:

[www.epa.gov/ttn/chief/net/1999inventory.html](http://www.epa.gov/ttn/chief/net/1999inventory.html).

3 - 9

*VMT Approach*

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- Distributions of VMT by roadway type, vehicle type, by hour of day can be applied directly to VMT or included within MOBILE 6 input files
- Also need to have speeds matched to roadway types either as average speeds or as speed distributions by speed ranges

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3-9

Preparation of Fine Particulate Emissions Inventories

In the case of the NEI, the VMT data was developed for use in conjunction with MOBILE 6 by using the distributions of VMT by roadway type and vehicle type. In some cases this activity data may be available by hour of the day.

Regardless of the format, these fractions can be applied directly to the total VMT, or they can be included within the MOBILE 6 input files in order to generate a weighted emission factor in MOBILE 6.

It is important to have speeds matched to the roadway types, either as an average speed or as speed distributions by speed ranges.

This latter approach is the approach needed for link-based VMT development and some transportation demand models.

3 - 10

*Level of Detail of VMT Data*

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- By county
- By roadway type (or link level)
- By vehicle type
- Appropriate time period

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3-10

Preparation of Fine Particulate Emissions Inventories

Ideally, the level of VMT data that should be used is by county and by the various roadway types or link level if modeling at that level is planned.

Using data by vehicle type is important since emission rates can vary greatly among the different vehicle types.

Using vehicle type data will allow the adjustments to be made to the national defaults that are typically used.

It is important to match the VMT data (daily or hourly) to the appropriate time period for modeling.

3 - 11

*Calculating Onroad Emissions*

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- Match VMT to corresponding MOBILE 6 emission factor
  - Map according to speed, roadway type (RT), vehicle TYPE (VT), time period
- $Emis = VMT * EF * K$ 
  - Emis = emissions in tons by RT, VT
  - VMT = vehicle miles traveled on RT by VT in miles
  - EF = emission factor in grams/mile by RT, VT
  - K = conversion factor

3-11

Preparation of Fine Particulate Emissions Inventories

VMT data should be matched to a corresponding MOBILE 6 emission factor and mapped according to speed, roadway type, vehicle type, and time period.

Emissions are calculated by multiplying the VMT data by an emissions factor as shown in the equation on this slide.

3 - 12

*Additional Resources*

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- User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model, EPA420-R-02-028, October 2002  
<http://www.epa.gov/otaq/m6.htm>
- MOBILE6.1 Particulate Emission Factor Model Technical Description, Draft, EPA420-R-02-012, March 2002  
<http://www.epa.gov/OMS/models/mobile6/r02012.pdf>
- Links to MOBILE6 Training Materials  
<http://www.epa.gov/otaq/m6.htm#m6train>

3-12

Preparation of Fine Particulate Emissions Inventories

There are a number of online resources to consult when developing an emissions inventory for onroad sources.

This includes EPA's online user's guide for using MOBILE 6.1 and 6.2, as well as technical documentation describing how the defaults were developed.

There are also links to training materials that have been developed as MOBILE 6 has been updated.

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